DOCUMENT RESUME

ED 088 557 JC 740 111

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TITLE The President, Colorado Community Colleges, Data Processing, and CAMPUS/COLORADO.
PUB DATE 10 Oct 73
NOTE 45p.; A report to the Colorado Association of Community Junior College Presidents

EDRS PRICE MF-$0.75 HC-$1.85
DESCRIPTORS Administrator Role; Computer Oriented Programs; *Computer Programs; Data Bases; *Educational Planning; Electronic Data Processing; *Management Information Systems; Models; *Simulation; *Statewide Planning
IDENTIFIERS *CAMPUS COLORADO

ABSTRACT

The community college president's role in facilitating institutional computer utilization is explored, and recommendations are made for his/her behavior and priorities in connection with educational concerns, institutional concerns, and statewide concerns. Typical institutional organizational arrangements regarding campus computers, research, planning and development and management information systems (MIS's) involve the following: (1) the director of research, planning and MIS reports directly to the president; (2) data processing, under this director, is a service-oriented function; (3) the development of MIS's and simulation models are a vital function of this director; and (4) two data processing committees exist; one is advisory and the other is user-oriented. To implement CAMPUS/COLORADO on a statewide basis, each institution must first create a data base that is compatible with a common statewide data base. When this has been done, institutional MIS's can be generated from the same data base. In addition, manpower and financial assistance should be supplied to any institution contemplating the CAMPUS/COLORADO model. Institutions currently implementing this model should validate it within the scope of a statewide data base before other institutions implement it. A central statewide computer center should also be established. (KM)

A REPORT TO THE

COLORADO ASSOCIATION OF COMMUNITY

JUNIOR COLLEGE PRESIDENTS

THE PRESIDENT, COLORADO COMMUNITY COLLEGES, DATA PROCESSING, AND CAMPUS/COLORADO

BY

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EL PASO COMMUNITY COLLEGE

OCTOBER 10, 1973

THE PRESIDENT, COLORADO COMMUNITY COLLEGES, DATA PROCESSING AND CAMPUS/COLORADO

INTRODUCTION

The preparation of this document is in response to a request by the Colorado Association of Community Junior College Presidents to increase their knowledge about data processing generally, and CAMPUS/COLORADO specifically, a computerized simulation model for state-wide use.

The nature of the CAMPUS/COLORADO model is such that it is primarily used for long-range planning purposes to assist upper-level administrators in upgrading their decision-making capabilities. The model provides endless amounts of information in a more accurate and concise manner than is otherwise available through a manual system where time and personnel are heavily restricting entities. The information derived from CAMPUS/COLORADO, however, is aggregated at a level such that it cannot be used, or does not meet all the needs, of a management information system (MIS)--a system primarily utilized at the institutional level for week to week and month to month operations. This conflict, whether an institution should begin with a MIS or a simulated long-range planning model, can be solved only with respect to what comes first, the chicken or the egg. There are those (The University of Colorado) who believe that long-range planning must come first. That then, and only then, can effective planning and management become a reality. The writer does not wholly disagree with this point of view. However, it is extremely important to look at what

information drives the model, where this information comes from, and the sequence and chronological order in which the information is retrieved. These chain of events, or procedures are what determines which comes first, the MIS or the simulation model. (See page 27).

Fortunately, in Colorado we are at a point in time when both methods can effectively be evaluated because both sides of the conflict are being implemented simultaneously at various post-secondary levels of education. However, before looking at a procedure for implementing the CAMPUS/COLORADO model, what was the motivation that sparked our community college presidents' requests?

Underlying their request, but not necessarily, specifically mentioned were two common, but essential, modern, basic management ideas. 1) Accountability, and 2) The desire and the need for Community College chief executive officers to increase their managerial and administrative effectiveness; and to become more aware of modern management practices as they relate to computer based management.

The central theme of this paper, then, is to 1) explore the Presidents' role with regards to institutional computer utilization; 2) to present typical institutional organizational arrangements with regards to campus computers, research, planning and development, and MIS's; 3) to explain a procedural format for implementing a computerized state-wide system approach to CAMPUS/COLORADO; and, 4) to present a discussion with recommendations for fully implementing a compatible and comparable state-wide system approach to a simulated model, i.e. CAMPUS/COLORADO.

THE PRESIDENT'S ROLE
REGARDING COMPUTER UTILIZATION

Introduction

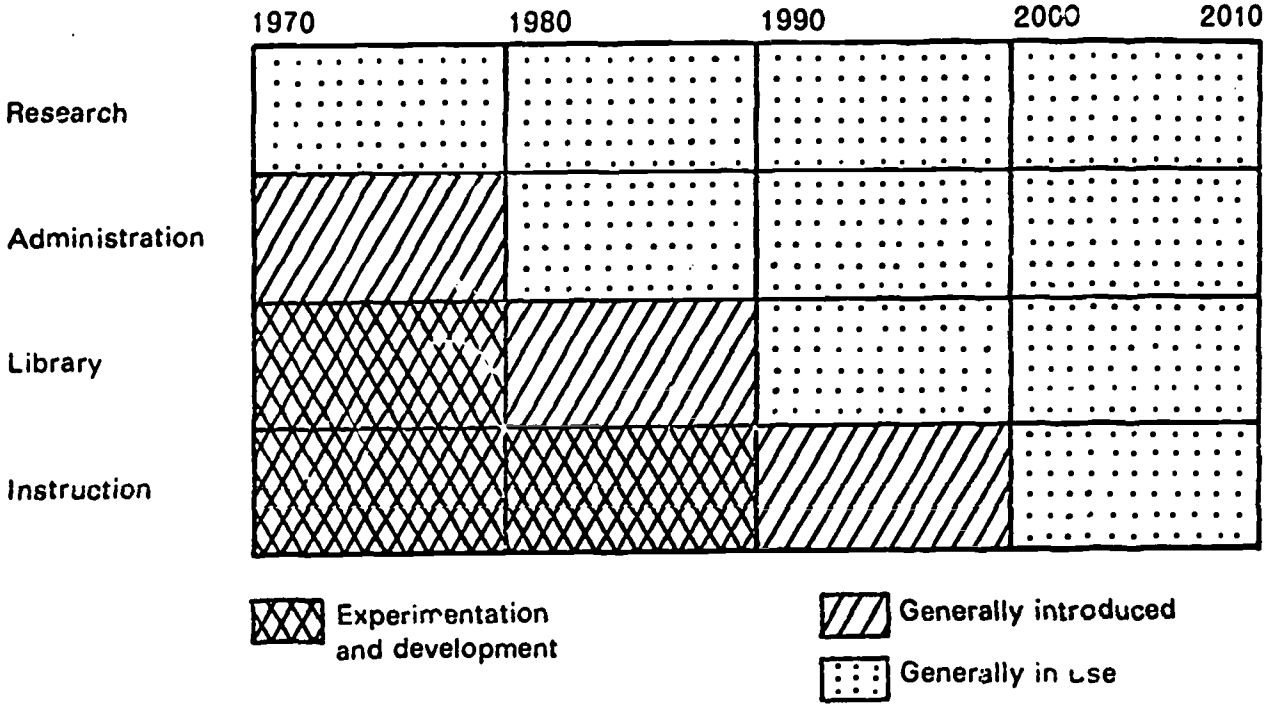
The Carnegie Commission on Higher Education presented their current status and potential utilization of information technology which is herein presented as Figure I, (A Carnegie Commissions Report: "The Fourth Revolution", June 1972). It is obvious from looking at Figure I that electronic technology in higher education is rapidly falling upon us. It is my belief that it is actually coming faster than the figure portrays. However, the Commission goes on to say, "the new technology may provide the single-greatest opportunity for academic change on and off the campus."

The chief component of electronic technology or the new technology centers around services, with primary emphasis on the computer or computer center.

Charles Mosmann (pp. 7-9), in his book, Academic Computers In Service, said,

> The computer is a complex resource. Allowed to grow unchecked, it naturally absorbs as large a share of the budget as its promoters can lay hands upon; groping for analogy, several writers have independently come upon that of cancerous growth. But suppressed, it drives some of the brightest students and most valuable faculty away and depresses the quality of education. -----the intelligent use of computers in instruction can do more for the educational quality of a college than can a comparable investment almost anywhere else. -----Faced with these dilemmas, the college president must resign himself to the fact that computing needs attention---his attention---if it is to be encouraged in the service of institutional goals.

FIGURE 1 ***Estimated use of electronic technology (computers, "cable" television, videocassettes) in higher education***



SOURCE: Staff of the Carnegie Commission on Higher Education.

FIGURE 1

Evans and Neagley (pp. 83 & 143) in their book, Planning and Developing Innovative Community Colleges, put it this way:

> Indeed, if a college expects to achieve excellence in teaching and learning in the 1970's and beyond, the institution must stress internal research that will help to evaluate the achievement of specific goals and objectives. Likewise, a community college that aspires to excellence in this technological age needs the support of a well-staffed, well-equipped computer center. -----a dynamic, alert, intelligent community college president is the key to successful utilization of the new technology-----. The president's obvious interest in the latest instructional and administrative applications---involving computers, for example---is bound to carry over to the other members of the administrative team and, hopefully, to the entire staff.

Mosmann (pp. 62 & 65) goes on to say:

> The final persona in this little drama (the computer center) is the top administrator of the institution, whose role it is to see that the other parts get along together and that the economic realities of the institution as a whole are also served.
>
> The difference in point of view among these elements is the key to understanding the organizational (emphasis added) problems of the computing center. -----the diffusion of responsibility to the point of stalemate has been the tragedy of computing at more than a few campuses. (Therefore,) a very talented individual with both academic and management skills must serve as the director, working full time to hold the pieces together.

It is obvious from the foregoing that the president's role and organizational structure are extremely important concerns. The president can accomplish much simply by recognizing these two basic needs and propogating there existence.

The President's Role

Charles Mosmann (p. 56) states that:

> At all but a few universities the---president usually

> devoted little attention to computing affairs. Only in a crisis that threatens the well-being of the college have the president and his closest associates stepped in to restore order. -----The most the president could ask was that the political crises remain rare and require little of his attention and that the cost of keeping the computer not become too large a lump in the budget. In fact, if it could be hidden altogether, so much the better. -----and, at least until fairly recently, few of them knew enough about computing to be aware that better management might make the computer more useful to them (and vise versa).

What can the president do, then, to overcome this image and to promote and foster an equitable computer center---a center that is economically sound, managerially effective, and instructionally oriented.

Following are some specific recommendations to insure that the President's role is compatible with the institution goals and objectives, and the computer center.

A. Educational Concerns: The president should:

1. become generally familiar with the jargon as used in the data processing arena. A president may avoid asking a question because he does not know the jargon; when in reality the question should have been asked because it may have settled a particular issue. Such terms as "hardware", "software", "computer language", "ADP", "EDP", "DP", core, compatibility, comparability, etc. are all common terms which should be readily available when the president wishes to use them.
2. acquire a general idea of the uses and limitations of the computer. Obviously, some jobs are too expensive to run on a computer; and, there are times when a computer is not big enough to run a particular job.

3. if time is available, which is frequently not the case, specific DP courses can be taken. For example, IBM offers short computer management courses which are for presidents only and are geared to the needs and desires of the president. If this is not possible, the bibliography at the end of this report will provide sufficient reading to accomplish the educational task.

B. Institutional Concerns: The president should:

4. insure that no one segment of the institution monopolizes the use of the computer. Frequently, if the computer center is not directly under the president, or a director of the computer center who reports directly to the president, one group, for example Business Services or the Registrar, may tend to utilize most of the computer centers time to the detriment of other segments of the institution. Considerable ill will is bred in this manner. Further, since instruction is the primary objective of the college, use of the computer for instructional purposes should demand top priority.

Evans and Neagley (p. 143), supporting the Carnegie Commission's, "The Fourth Revolution", report on the use of educational technology, had this to say:

> The community college president---can do much to encourage the use of educational technology in the college. He can direct the development of a sound---program by demonstrating positive, democratic leadership in the following ways:
>
> 1. Analyze the budget to determine total funds expended

for various instructional media in the several subject and program areas. Such a study should show differences in expenditures between general and specialized education. The administration will then know exactly what the media dollars are buying.

2. Read as much as possible in the field and route pertinent articles and books to other members of the staff. Keep up-to-date on new developments.

3. See that the agendas of the administrative staff or instructional affairs council provide for periodic discussions on learning resources.

4. Support budget requirements for various media that grow out of current curriculum studies in the college and are recommended by the academic dean.

5. Work with other institutions in the area and state to provide or expand needed cooperative services in learning resources.

6. Visit innovative educational institutions and learning resource centers at least two or three times a year. It is easy to get into a rut, and getting out of the office for such field trips is a healthy experience for any college president.

7. Spend considerable time in the classrooms and learning centers to observe the role of media in many teaching-learning situations.

8. See that the board of trustees gets periodic reports on the learning resources program and its contribution to the fulfillment of instructional objectives. Invite key personnel, such as the director of learning resources, to make visual presentations to the board on occasion.

9. Make sure that professional contracts provide released time for participation of all staff members in the program of curriculum development, including selection of appropriate instructional media.

Mossman (p.59) says:

5. "Create an administrative structure that will recognize problems, prevent them if possible, or deal with them as they occur. He should

permit technical problems to be solved by technicians, educational problems by educators, and administrative problems by administrators." See discussion under Control and Management.

6. insure that the Director of the computing center has a sound academic background, and is management oriented and effective. This person should report directly to the president and have a good working knowledge of the computer center and its institution and state-wide applications. A strong background in computer technology is not necessary since technical personnel handle this aspect of the operations. However, he should have a general working knowledge of the technical aspects of the computer.

7. see that sound computer policy is specifically established. Technical issues must not be confused with political issues; lack of policy prohibits the consideration of new and perhaps radical alternatives (people may be too timid to "buck" the "dyed-in-the-wool" system); basic policies can promote long-range planning (none or poor planning results in high costs, poor service, and duplication of effort); set policy by a computer policy committee or advisory committee or a management information committee; resource allocation must be considered; the computer center budget analyzed; priorities established; responsibilities assigned; long-range plans delineated; and a means provided for continual updating of the policy.

C. Statewide Concerns: The president should:

8. continuously make known to state level operations his concerns

about state-level requests. That is, he must inform state-level administrators of his institutional needs, as well as, areas of conflict. Not to inform state-level personnel of these concerns can only compound the problems of a negative situation, widen the communications gap between the institutional and state-wide operations, and put the president in a weakened position of authority with more and more "power" going to state-level personnel and operations. This loss of authority at the institutional level has been graphically displayed over the last few years by the encroachment of legislative mandates. Colorado definitely has not been immune to this situation.

9. provide state-level administrators with specific suggestions regarding the use of a state-wide, post secondary computer center. For example, it should <u>almost</u> never be necessary for a state-level person to request commonly computer-stored information directly from an institutions DP center. College and University statistical data should automatically be fed into a state-wide educational computer center, from each institutions own computer center. Furthermore, each (local and state, centers data could be updated simultaneously such that a state-level director could call for any information he wishes, that was stored in the state-wide central computer, and have up-to-date information printed in any format he desired and at any time he requested. All this could be done without interrupting the local institutional operations at any time.

All of the foregoing suggestions for presidents, to assist him in his administrative computer role, must constantly be viewed in the light of the over-all institutional goals and objectives and within the operations of state-wide parameters. However, in order to accomplish these goals and objectives with maximum efficiency and minimal problems, and from the standpoint of computer management, the organizational structure of the data processing center must be carefully evaluated. In addition, the production of an instructional data processing arm, a research arm, an institutional-state-wide common data base, a management information system, and a simulation model must be of primary concern when the organizational structure of the computer center is formulated or changed. The following sections of this report deal more specifically with these concerns.

THE ORGANIZATIONAL STRUCTURE, CONTROL AND MANAGEMENT OF AN INSTITUTIONAL COMPUTER CENTER

Organizational Structure

The organizational structure of each institution's computer or data processing center will depend on the size and composition of the institution. However, sound management planning at the earliest possible stage in the development of the college will help minimize problems of money and personnel. As the college grows, an increase in the amount of money to run the center and the number of personnel will be needed. Continuous long-range (Five Year) projection of needs will help assure an orderly development of the center, and the individual component parts of the operation can be "phased in" in a smooth and orderly manner to fit precisely the ever increasing needs. Another advantage of long range planning is that it keeps the state-level and legislative personnel continuously apprised of your intent as well as progress. (It is "easier" for state-level personnel and legislators to accept something they "expected" and which was well planned rather than accepting something they did not anticipate at all, or knew nothing about.)

Figure 2 shows the typical component parts of a data processing center. Under each of these major headings would be listed one or more performance tasks. Stevenson (p. 2) developed an electronic data-processing systems model which assigned ten specific DP areas of concern. These were: manpower inventory, payroll, business functions, admissions, registration and records, financial aid, counseling, test marking, alumni records, and

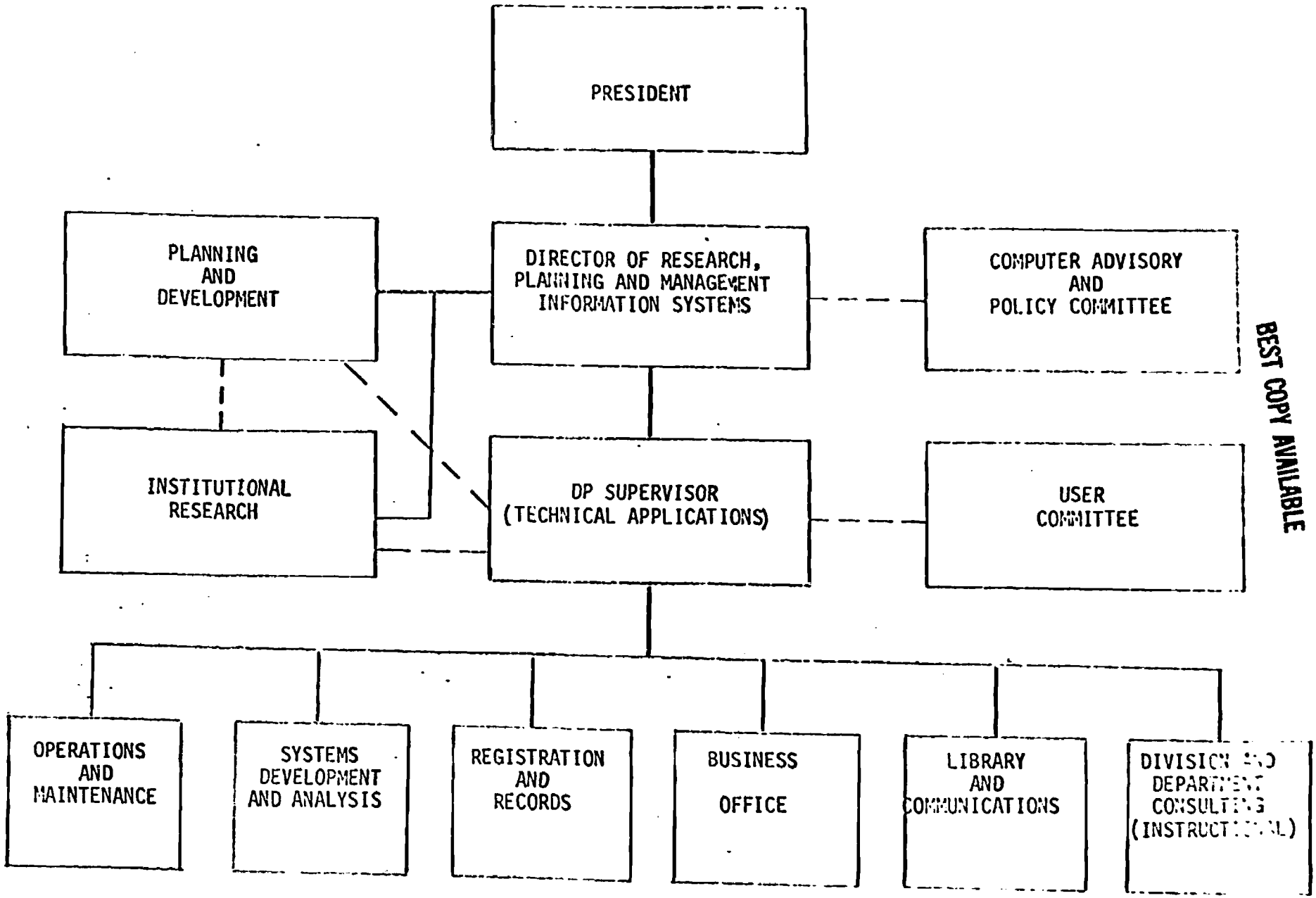


FIGURE 2

institutional research. I would add to this list the library area and an instructional area to make a total of 12 performance task areas of concern. Almost all community colleges perform all 12 of these tasks.

Figure 3 shows the typical major functional areas in a comprehensive community college to which the 12 performance task areas mentioned above can be assigned for coordination. While institutions vary from one to the other in their organizational structure, most have a structure similar to that shown in Figure 3.

Figures 4, 5, 6, and 7 represent organizational structures of four leading and innovative comprehensive community colleges in the United States. Most community college presidents are aware of these particular institutions and their accomplishments. But of most importance to the problem at hand is the computer center.

What are the organizational characteristics in which the computer center is located that seem to be common or nearly common to all five (Figures 3-7) organizational structures? These are as follows:

1. The director or dean of research, planning, and management information systems reports directly to the president. For reasons previously mentioned this becomes almost a necessity.
2. Data processing, like the business area, is a <u>service</u> oriented function and is only one of several areas assigned the director of research, planning and MIS.
3. Because of their integral and dependent nature, planning and development is another function also assigned to the director in charge of data-processing.

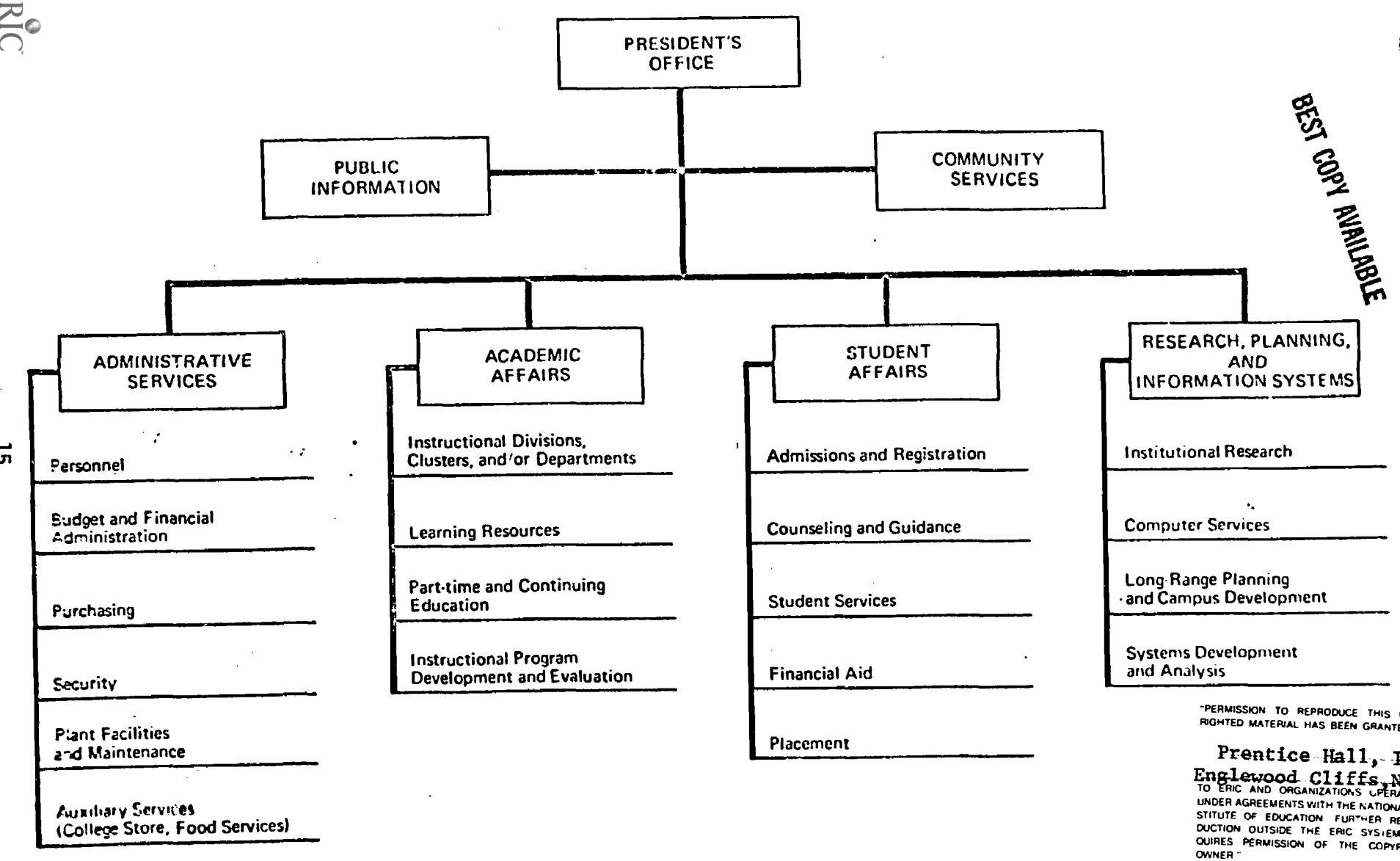


FIGURE 3 Major Functional Areas in a Comprehensive Community College

(Evans & Neagley, p. 75)

WILLIAM RAINEY HARPER COLLEGE ORGANIZATION CHART 1969 70

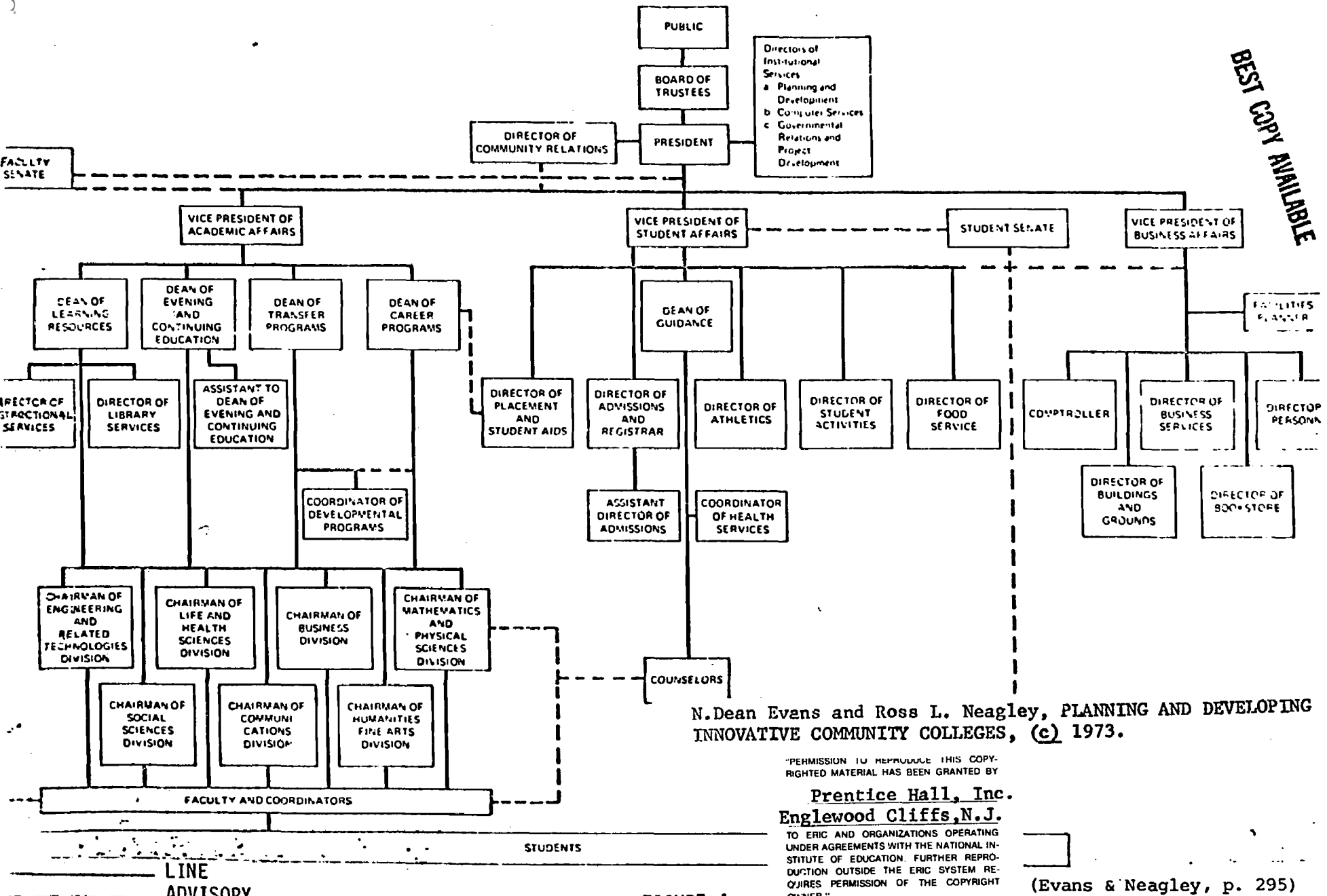


FIGURE 4

N. Dean Evans and Ross L. Neagley, PLANNING AND DEVELOPING INNOVATIVE COMMUNITY COLLEGES, (c) 1973.

(Evans & Neagley, p. 295)

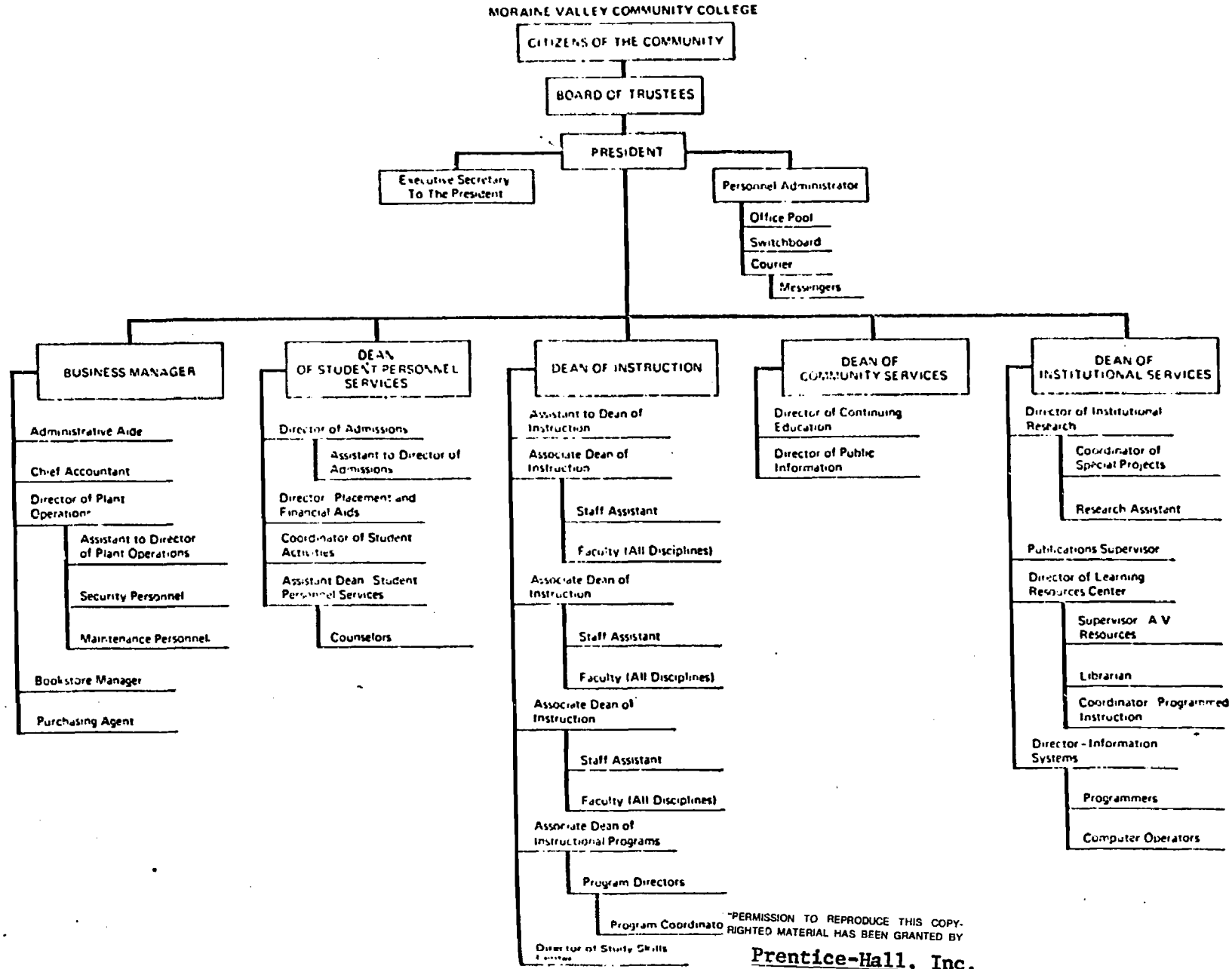
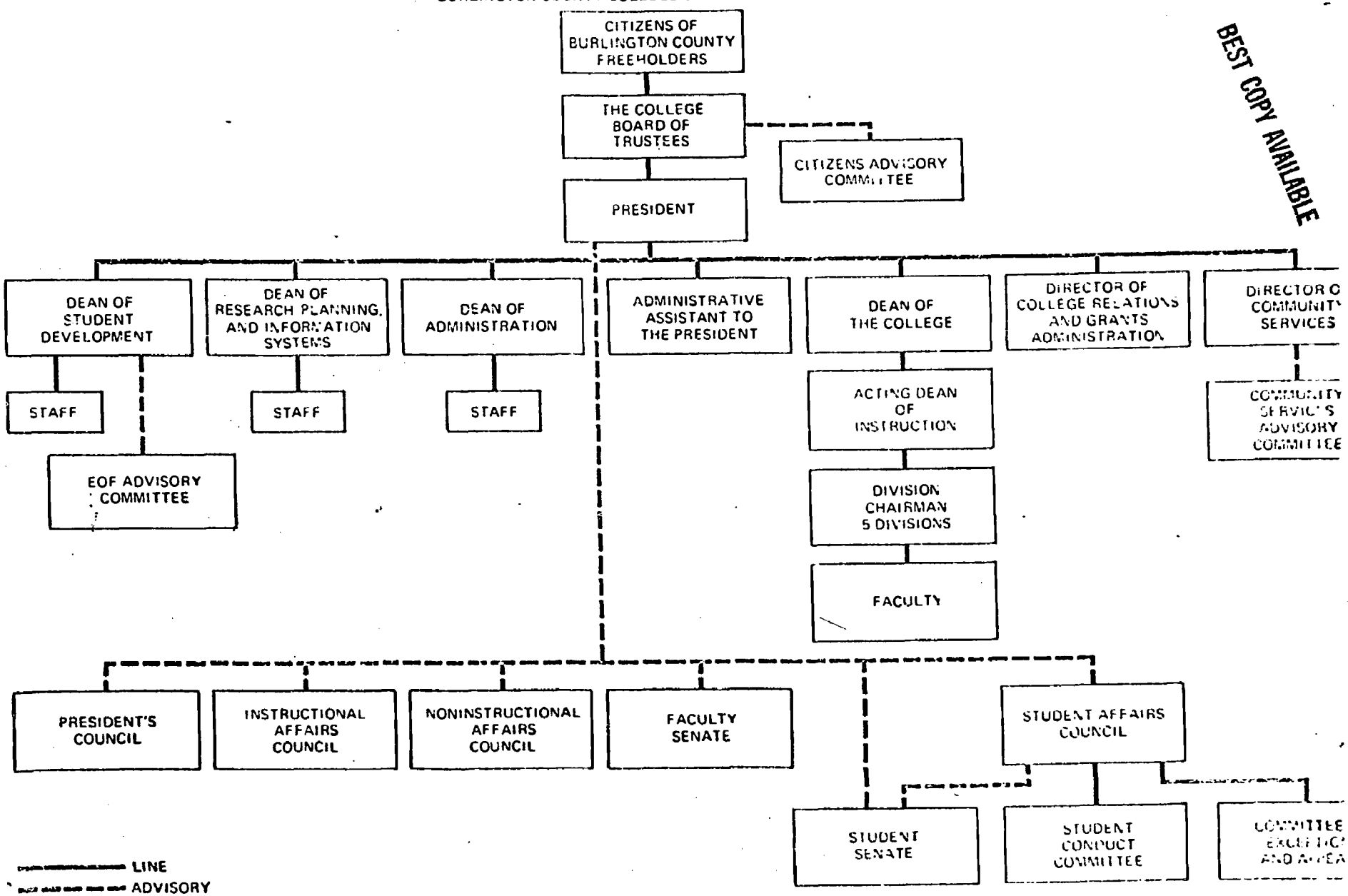


FIGURE 5

N.Dean Evans and Ross L. Neagley, PLANNING AND DEVELOPING INNOVATIVE COMMUNITY COLLEGES, (c) 1973.

(Evans & Neagley, p. 290)

BURLINGTON COUNTY COLLEGE ORGANIZATION CHART



N. Dean Evans and Ross L. Neagley, PLANNING AND DEVELOPING INNOVATIVE COMMUNITY COLLEGES, (c) 1973.

FIGURE 6

(Evans & Neagley, p. 293)

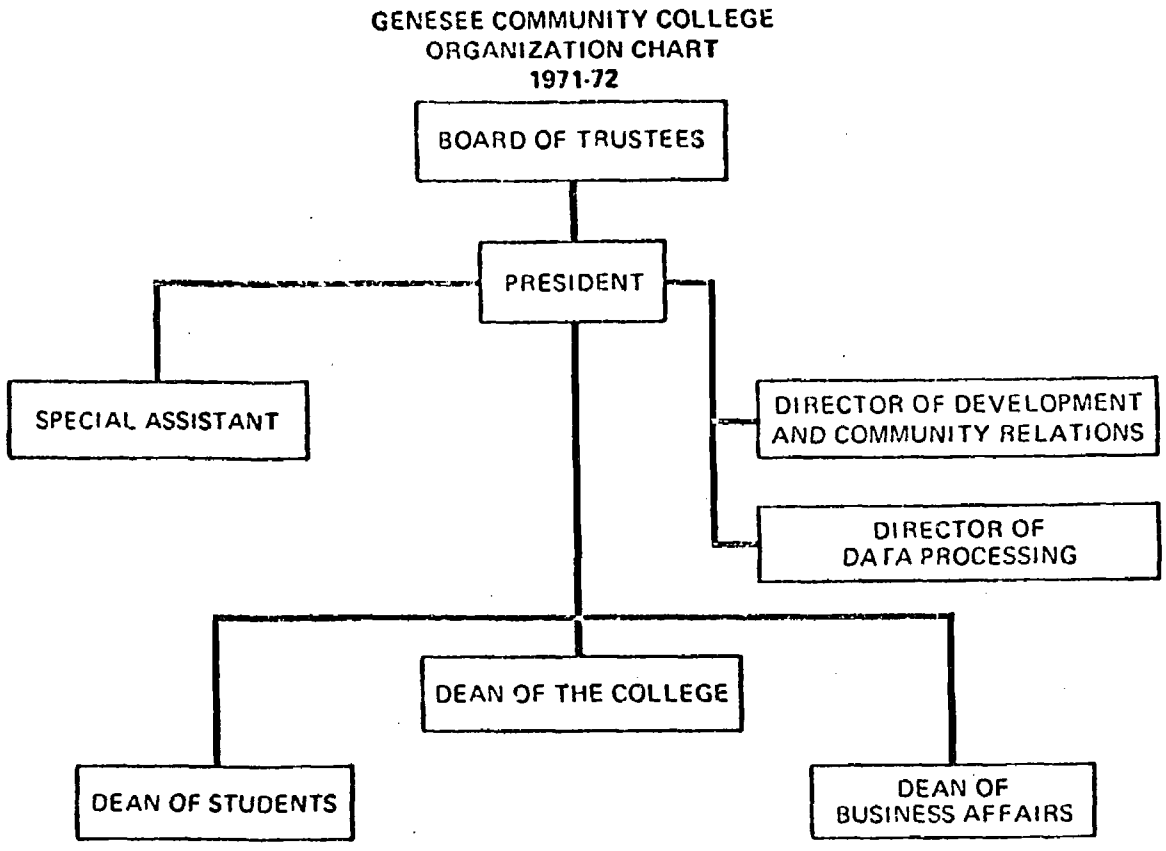


FIGURE 7

(Evans & Neagley, p.

N. Dean Evans and Ross L. Neagley, PLANNING AND DEVELOPING INNOVATIVE COMMUNITY COLLEGES, (c) 1973.

4. The development of management information systems and simulation models (CAMPUS/COLORADO) are a vital function of the Director of Research, Planning, and MIS. Such models as Program, Planning and Budgeting systems (PPBS), and the Resource Requirement Prediction Model (RRPM 1.6) or their equivalents are typical of the MIS being developed in the forward thinking comprehensive community colleges.
5. Not specifically shown on the organizational charts, but which is outlined in Figure 2 are the data-processing committees. Ideally, there are two. One advisory or policy committee which sets specific and general policy for institution wide use of the computer; and the second committee, which is "user" oriented, is designed to solve the seemingly endless number of technical problems. The former committee is composed of the director of Research, Planning, and MIS and the chief administrative officers (directors and deans). The president will want to be very closely associated with this group, and may even be its chairman. The latter group is composed primarily of the "users". Principly, technical personnel, faculty, librarians, business personnel and other prime users. The D.P. supervisor, or the individual responsible for technical applications would chair this committee. Other interested parties include students and other classified help which could be members of both committees.

The above five entities, while common to all organizational structures presented, are more than just "common". They are practical necessities to the computer centers operation and success.

Having the computer center organizational unit separated (but not physically separated) from the other major organizational units of the college has many advantages:

1. No particular group dominates the computer or its use.
2. All groups have equal access.
3. It represents a center for evaluating management goals and objectives.
4. It can respond individually and more rapidly to the user's needs.
5. It is a central location for evaluating institutional performance, since all aspects of the college funnel through the computer center.
6. It is a center of campus politics. (Mosmann (p. 7) put it this way:

> Computing is expensive and it is a critical resource for many functions that cut across all avenues of campus life. It thus represents influence and power, and a share of its control is jealously guarded by many. The assistant provost of a major private university said in a recent conversation, "the computer is really the center of all the damned political to-do on the campus. That's where the money is and that's where all the issues meet face to face. So many of the questions of where we are going and who's going to control what are fought out in the computer area ----- Issues seem to get turned around and backed into the computer committee. It's a storm center. It's a <u>good</u> place to fight."

I might add that many of the inter-divisional hassles that occur on college campuses are drawn away from the respective divisions concerned and settled in the computer arena, where a good advisory or policy committee can effectively deal with them. Thus, the committee absorbs upon itself the brunt of their respective attacks, much to the satisfaction of the individual parties who are now able to continue their previous "friendly" ways--comfortable in the thought that each has received equitable treatment from an "unbiased" committee. However, if the computer had been located in one of the divisions which was a party to the hassle, or in a division that could

become party to a hassle, the situation could be compounded; instead of one hassle you would then have two or more. Therefore, the positive aspect of being peripheral to inter- and intra-divisional rivalry is certainly a very desirable management technique.

Organizational structure, therefore, is extremely important when considering the organizational location and organization of the computer center. Of equal importance is the centers control and management. The following section, therefore, deals more specifically with the control and management of a computer center.

Control and Management

Figure 2 is a graphic display or chart of the line and advisory functions of a computer center. The functions exhibited in the chart are specifically designed for control and management purposes, the key to which lies in three specific locations on the chart. These are: 1) the Director of Research, Planning, and MIS, 2) the computer advisory and policy committee, and 3) the user committee. These three separate entities control and manage the entire operation. For this reason, then, it is vitally important that the personnel comprising these three aspects of the chart be representative of the institution as a whole and be ever mindful of the immediate and long-range goals and objectives of the college.

Following is a job description for the director of Research, Planning, and Information Systems. This description was developed by Burlington Community College personnel (Evans & Neagley p. 303) with only very slight modifications by the writer.

Job Description
Director of Research, Planning and
Information Systems

I. Narrative Description

The Director of Research, Planning, and Information Systems reports to the President and is responsible for three major areas of institutional service: research, planning and development, and information systems. Since many departments of the College are involved in these areas emphasis should be placed on the coordination and leadership of this position.

One basic function of this position is to encourage good decision-making by insuring that accurate and timely data and meaningful analyses of the data are available to all departments of the College and specifically to the President, the President's staff, and the Board of Trustees. A major operational responsibility is the direction of the central data processing complex serving the needs of the College.

II. Functional Responsibilities

A. Research

1. Coordinate continuing studies in the areas of curricula, instruction, staff, buildings, facilities, and financing, working closely with departments, having operational responsibility for these areas. Assist those departments that have a research capability and conduct studies in the others or when requested by the President.

2. Coordinate the preparation of institutional reports to local, state, and federal agencies.

3. Direct studies of other areas which are considered important to the institution as approved by the President.

4. Development of programs to evaluate how well the College is progressing toward its objectives.

5. Centralize and coordinate the answering of surveys and questionnaires from outside agencies.

B. Planning and Development

1. Coordinate the preparation of analyses of future needs and resources, including specifically, enrollment and facilities projections.

2. Develop educational specifications for future campus development and communicate facility objectives to architects.

3. Coordinate campus design with architects, consulting engineers,

other specialists, and appropriate College personnel, including, where feasible, the processing of change orders during construction.

4. Working closely with the Director of Administration, coordinate budget planning for both operational and capital needs for preparation of the annual budget.

5. Plan for the implementation of a simulated Program, Planning, and Budgeting System (PPBS) responsive to the needs of the College.

C. Information Systems

1. Implement and direct a College forms control program.

2. Coordinate the development of systems and procedures (manual and automated) of an inter- and intra-departmental nature, including responsibility for the control and distribution of the official Policy and Procedures Manual.

3. Direct the operation of the College Computer Center.

4. Prepare specifications, evaluate, select and implement new hardware which will provide needed informational and computational resources.

III. Consulting Task

1. Participates in the discussion, formulation, and administration of College policies as a member of the President's staff.

2. Participates in the development and construction of the College budget.

3. Is involved, consulted, and actively takes part, in the administration of construction contracts for new facilities.

4. Is consulted before any changes are made in procedures or methods involving any data processing application.

5. Participates in the formulation of staff personnel policies and procedures.

6. Is consulted before any significant research studies are conducted.

7. Participates in the development of the curriculum Master Plan.

8. Is involved and consulted in the building of the College calendar.

9. Is consulted in the building of each term's Master Schedule.

IV. Required Skills

Administrative experience in higher education which must have included experience in educational data processing is required. Either direct experience in research and planning in higher education or the equivalent in academic course work.

V. Required Educational Background

A doctorate or substantial work toward the doctorate is desirable, with a major in higher education or educational administration.

It is obvious from the foregoing job description of the director of Research, Planning and Information Systems where the emphasis should be placed. They are: 1) He reports directly to the president, and 2) he is a coordinator serving the entire institution.

Mosmann (p. 14) pointed up the need for number one above when he said:

> The comptroller insists that he will use a computer service in common with academic users only if he is guaranteed that (1) his work will have top priority (since the payroll is obviously the most important data processing job on the campus); (2) provision will be made for getting his work done on some other machine if the one on campus should be out of order when he needs it; and (3) the location and staff of the computer will be selected to guarantee the security of his data, programs, and reports.

Further, Mosmann (p. 69) goes on:

> Many campus computer center directors report to the chief business officers of their colleges, particularly when their centers serve both administrative and academic users. Although the chief business officers and the computing directors who report to them may deny it, it is usually obvious to a visitor that in these cases the academic personnel have small voice in managing the computer and make small use of it. It seems reasonable to predict that as such centers come to serve the academic community better, the responsibility for their management must be passed from the business officer to a more general officer of the college, such as the provost (DP director) or the president.

The computer center User Committee is composed of the DP Supervisor (the technical man) and representatives from major groups of users. Their major concern is to iron out technical difficulties which may arise during week to week operations. It also serves as a communications net work for the users to express their problems to the DP Supervisor, and for the DP Supervisor to explain why it is not always possible to comply with each of the users complex needs. Further, the DP Supervisor can assess the users reactions to potential changes in the system.

However, Mosmann (p. 70) points out:

> Because of their (the User Committee) focus on service rather than cost, on effectiveness rather than efficiency, user committees make a bad organ for planning; that function is better performed by the more broadly-based policy committee.

The recommended organization, control and management of the Research, Planning, and Computer Center as mentioned above, has been successfully implemented in many community colleges in the United States, of which those previously mentioned are but a few. The important aspect to remember is that regardless of the size of the institution, similar functions are preformed at all of them--the only difference is the number of personnel performing the assigned tasks.

Several of these assigned tasks have to do with implementation of a common institutional-state-wide data base, a management information system (MIS), and a simulation model (CAMPUS/COLORADO).

The remainder of this report deals specifically with implementation of these three tasks.

SUGGESTED PROCEDURE FOR FURTHER IMPLEMENTATION OF CAMPUS/COLORADO AT OTHER COLORADO INSTITUTIONS OF HIGHER EDUCATION

INTRODUCTION

At this point in time the State of Colorado does not have a fully compatible and comparable state-wide data base; therefore, each institution, by necessity, has developed over the years, some form of MIS. A system which satisfies the most basic needs of each institution, but not necessarily satisfing the ever-changing needs of a state-wide system. Therefore, it is important to outline a suggested modified procedure for continued implementation of CAMPUS/COLORADO based on experience gained during the first 18 months of operation. The general plan of this procedure would be to form an institutional data base that is compatible and comparable with a common state-wide data base. Once this data base was firmly established in each institution and on a state-wide basis, then institutional MIS's could be generated from this same data base. This is not to imply that both processes cannot be carried out simultaneously. Thus, the data base would generate, at a higher level of aggregation, the the institutional MIS.

The next level of aggregation would be at the CAMPUS/COLORADO simulation level. Data from each institution's MIS would be utilized to produce the CAMPUS/COLORADO planning model results. These results would be compatible with both the state-level needs as well as the scope of the information needed within each institution.

Finally, the interfacing that takes place between the data base and the MIS, and the interface that occurs between the data base and the MIS and the CAMPUS/COLORADO planning model are the crucial items needed to have a full-blown state-wide systems approach.

In order to generate such data, it is imperative that we look at 1.) the state-wide and institutional goals and objectives; 2.) those institutions currently implementing CAMPUS/COLORADO; and 3.) a procedural format that would supply the information necessary to have an institutional data base, MIS, and CAMPUS/COLORADO planning model.

State-Wide Goals and Objectives

In order to satisfy fully the state-wide needs as well as the institutional needs, it is important that state level agencies fully define the requirements of their respective offices and the requirements of the CAMPUS/COLORADO model.

Such information as budget, data currently needed for the B-1 and C-1 reports, faculty activity analysis, student parameters, information from the JBC and EBO (both on a short and long term basis) and individual institution input; as well as, a whole host of other bits of information required by the state should be compiled and reduced to its simplest terms.

The compilation of common base, data element dictionaries by CCHE to cover specific areas or modules of information should be generated on a state-wide basis and in conjunction with all state institutions.

In the generation of compatible and comparable institutional data, the following differences between the state and institution and between respective institutions may exist: 1.) The institutional data base could

be the same as the state's data base (this, however, is not likely at this point in time); 2.) The institutional data base currently is different than other institutions data base, and 4.) The more obvious case, the institutional data base is partly the same as and partly different than the state-wide data base. It is important, therefore, that the degree of differences and similarities be carefully analyzed and itemized such that 1.) all the institutional similarities and differences be fully identified, 2.) determine what is common to the state and each institutional data base and what is not, and 3.) how much change or what is the degree of change necessary to isolate the differences and produce a state-wide common, compatible and comparable data base. Once these differences and commonalities have been identified, a state-wide data base could be produced by using each institutions unique informational data base coupled with the state-wide data base. These, in turn, would produce each institutions MIS that would also be compatible with the state-wide system.

Institutions Currently Implementing CAMPUS/COLORADO

In addition to the personnel at the CCHE, other personnel are being trained at those institutions currently implementing CAMPUS/COLORADO. These institutions are the University of Colorado, Southern Colorado State College, Mesa College, and Arapahoe Community College. Personnel from these institutions should be in a position to furnish assistance to other institutions contemplating the use of the CAMPUS/COLORADO model.

Assistance could be furnished in three ways: 1.) by relief time given to those personnel currently implementing CAMPUS/COLORADO at their respective

institutions so that they could instruct at the new institutions planning the CAMPUS/COLORADO implementation; or 2.) personnel from the newer implementing institutions could be sent as interns to those institutions currently implementing CAMPUS/COLORADO; and 3.) a combination of the first two. This would not only have the benefit of more state-wide exchange of ideas and increasing the number of institutions on CAMPUS/COLORADO in the state-wide system, but it would tend to reduce the number of required man hours of qualified consulting.

Before continued implementation of CAMPUS/COLORADO takes place at other Colorado institutions, the current CAMPUS/COLORADO model should be completely validated, or as much as possible should be validated within the parameters set forth in the common state-wide institutional data base. This does not mean that everything must come to a halt regarding the implementation of CAMPUS/COLORADO at other Colorado institutions of higher education. It simply means that we are at a point in time in which we must stand back and look at the tremendous amount of data that has been collected, what has been accomplished, and to establish a very definitive road as to where we want to go.

In order to insure that continued orderly process of implementation, the 1973-74 year should be spent concentrating on 1.) a common data base; 2.) education of institutional, state, and legislative personnel; 3.) the production of an Induced Course Load Matrices (ICLM) at those institutions wishing to implement CAMPUS/COLORADO; and 4.) a somewhat detailed procedural format for implementation of CAMPUS/COLORADO at other institutions.

Since some institutions are in the process of implementing RRPM 1.6 (for example, the University of Northern Colorado, Colorado State University, and Southern Colorado State College), it will be necessary to produce a modular cross-over network that will bring the RRPM orientated institutions into the CAMPUS/COLORADO system. This can be accomplished by writing a cross-over program that will take into consideration the specific needs of RRPM and transform them into the specific requirements of the CAMPUS/COLORADO model.

In addition to the need for a cross-over module between RRPM 1.6 and CAMPUS/COLORADO, there is a distinct need for a method to display graphic data.

Through the use of X-Y plotters, which give a two dimensional graphic presentation of data, and the use of Calcomp plotters (or their equivalent) which can graphically display three dimensional arrays, a considerable amount of numerical data can rapidly be reduced and displayed for easy reading and interpretation. In addition, few if any MIS or simulation models, including CAMPUS/COLORADO and RRPM 1.6, display numerical data in percentages of incremental change. This is particularly undesirable in view of the fact that such information is one of the most common ways of evaluating institutional and/or state-wide changes.

A Suggested Procedural Format

Figure 8, A SUGGESTED PROCEDURAL FORMAT FOR IMPLEMENTING A COMPUTERIZED STATE-WIDE SYSTEMS APPROACH VIA CAMPUS/COLORADO, shows a general format of levels of aggregation and information as well as the interfacing that

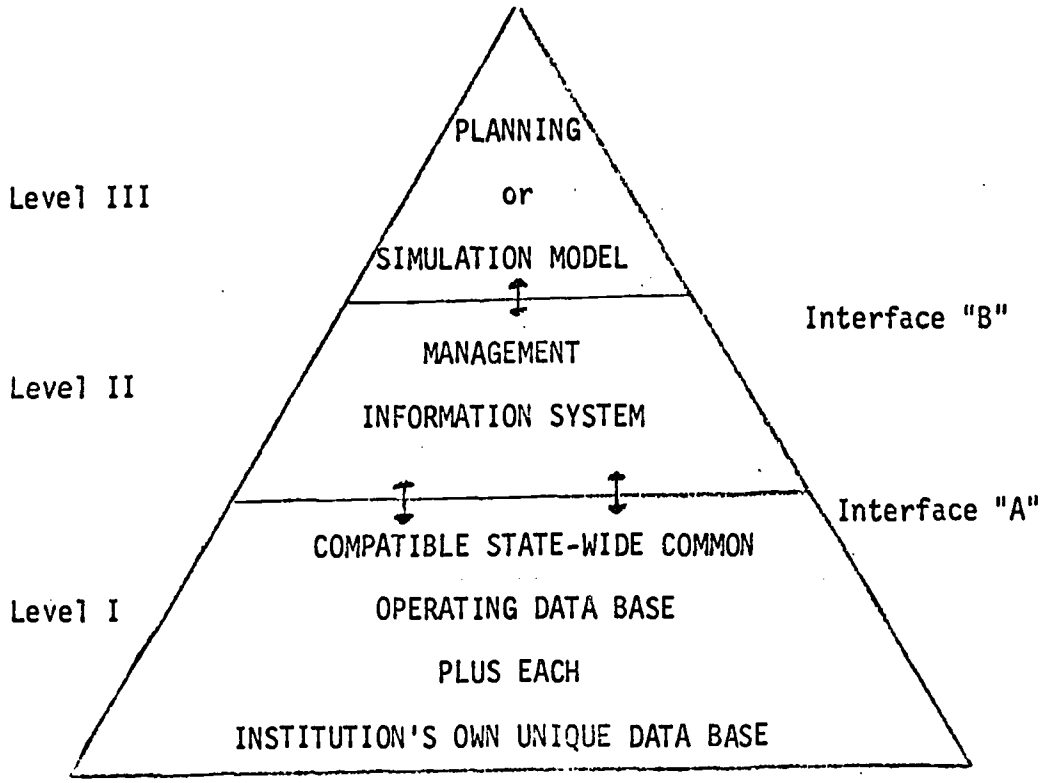


FIGURE 8

takes place between the respective levels. The figure is presented in a triangular shape to indicate the higher degree of aggregation existing at level III, and also the reduced amount of total information required at that level.

Level I denotes the institutional operating data base which is compatible and comparable with a state-wide system but also contains information unique to each institutions own data base.

Level II represents each institutions MIS predicated upon the level I information and aggregated to level II.

Interfacing between and transgressing the boundary is interface "A". Interface "A" represents the first level of reduction of information to produce a higher level of aggregation, which, in turn, produces the MIS comprising level II. Such data as individual faculty loads, student enrollments, credit hours, contact hours, space utilization (including room type, numbers, and size), and many other criteria are produced at the department level by the level I, state-wide common information data base. The level II MIS would be composed of the above information (faculty load, etc.) at the next higher level of aggregation; for example, at a divisional or dean level. This procedure has the advantage of isolating the MIS from the institutional operating data base, while allowing continuity and flow of information between the respective levels in which all data for all levels is based on the same numeric values. In addition, it reduces the amount of overlap and errors often found in institutions which have relied on the production of a MIS or planning model prior to the development of a sound comparable and compatible data base. In other words, the MIS or simulation model was

developed in isolation of the COMPLETE informational data base.

Once it has been insured that all institutions are operating on a state-wide, common data base which is both compatible and comparable, then the generation of each institutions MIS is likewise automatically a compatible and comparable state-wide MIS.

Once level II has been achieved and validated, the process of going to level III, the planning or simulation model level (CAMPUS/COLORADO) represents the highest level of aggregation of data and is operated by level II information screened through interface "B". Interface "B", then, becomes the point at which information feeding the MIS has been aggregated to level III. This is done by picking and choosing only those pieces of information needed to generate the CAMPUS/COLORADO model, whatever this information turns out to be.

The sequential steps of the procedure, then, are step 1.) to generate a state-wide compatible and comparable common data base which dovetails precisely with each institutions own data base; step 2.) at interface "A", only the information necessary to completion of the level II MIS is required and thus aggregated; and, all other information is left behind. Step 3.) is the production of the institutions MIS: while step 4.) is the reduction of data reported through interface "B" which produces step 5.) or level III, the information required for the simulation model (CAMPUS/COLORADO). The net result of the entire procedure then is to produce a state-wide compatible and comparable information system which is tailored to each institutions unique needs as well as to the needs of state-level operations.

The implementation of a process which builds successively on each larger level of aggregation, which has its base data generated on a state-wide common data base, almost automatically produces a state-wide Management Information System, as well as, a state-wide simulation model.

DISCUSSION AND RECOMMENDATIONS FOR FURTHER IMPLEMENTATION OF CAMPUS/COLORADO

The following discussion and recommendations are made in light of the process described above, a review of the literature relative to CAMPUS/COLORADO, and campus visitations to colleges and universities currently implementing CAMPUS/COLORADO.

1. Common State-Wide Data Base

The state of Colorado is now at a point in time where a diligent effort needs to be made regarding the formulation of a common state-wide data base. This common data base could be developed by providing a layout or format that would specifically show the institutional differences and similarities. A compilation of this information could result in the production of common state-wide data element dictionaries which could still reflect institutional differences wherever they may be applicable. Subsequent to the completion of the data element dictionaries, all changes, additions, or deletions to the dictionary would be processed through a centralized committee to insure the continuity of the common data base.

2. Institutional Management Information Systems

The development of an institutional MIS, has to a degree, already been undertaken by most colleges and universities in the state. The problem is, that only a few of the data elements comprising the MIS are common to all institutions. As a result

the necessity to complete number 1. above becomes more imperative, since the development of a sound MIS is predicated upon the information derived from the common data base. Further, the information that makes up the common data base and feeds the MIS is the same data necessary to drive the CAMPUS/COLORADO model. Therefore, very careful consideration must be given to the common data base prior to full implementation of either a MIS or a simulation mode

To begin a sound MI[illegible] neration of an Induced Course Load Matrix (ICLM) is an integral [illegible]t of the common data base. This requires the distribution of credit and contact hours across the institutional course offerings and results in "loading" the departments and calculating their needs. This procedure, however, should be fully integrated into the other sections of the common data base and on a compatible and comparable bases.

3. Assistance Needed to Implement CAMPUS/COLORADO

The CAMPUS/COLORADO model is a very complex model, and as such, assistance in the form of manpower and financial aid should be supplied to any institution contemplating putting up the model. It is not realistic to assume that colleges and universities can continue to absorb costs by simply taking on another task. The use of this procedure is not only morally unsound and managerially ineffective, but it tends to inculcate a defensive attitude on the part of those in charge of performing the tasks required.

Careful consideration must be given to using personnel at those institutions currently in the process of implementing CAMPUS/COLORADO to assist those colleges and universities contemplating putting up the model. In addition, personnel from CCHE with some support from the SBCCOE could assist each institution in their efforts to comply with state-wide necessities.

Where qualified Colorado personnel are not available for assisting other institutions, then well qualified consultants could be hired for this purpose.

It would be very desirable to set up a definite training program to assist those institutions who do not have a common data base, a management information system, and a simulation model. A haphazard, go-it-alone, hope-you'll-get'it approach will do more harm than good, cost more money, and take longer to complete.

A training program could be initiated by CCHE staff members who are currently implementing the model at other post-secondary institutions. Their experience would be invaluable to the newer institutions coming on the system. Further, these same personnel could acquire additional experience as they put on more colleges and universities; as well as, debugging the system to reduce it to a more modular state, which in the long run, could reduce costs.

Finally, adequate time must be given each institution coming on the system to fully evaluate their own unique data base, how their data base fits into the state-wide common data base, the needs of their management information system, and the parameters needed to dovetail with the CAMPUS/COLORADO model. The supply of adequate time

would also tend to reduce the number of data errors which in turn reduces the production of erroneous output data.

4. Validating and Evaluating CAMPUS/COLORADO

It is extremely important that the colleges and universities currently implementing CAMPUS/COLORADO or RRPM 1.6 carefully validate the model within the scope of a statewide data base before proceeding to other institutions for full implementation of either of these models. Validation as used here, means a complete "debugging" process such that there is compatible and comparable information exchange with state level operations, all of which are on a common data base.

The structural arrangement of the CAMPUS/COLORADO model nearly reproduces the organizational structure of each college or university using the model. While this is not a necessary prerequisite to the use of the model, it is generally dictated by the structure of the organization, the allocation of resources, and the distribution of cost centers across the institution. Therefore, when CAMPUS/COLORADO is being implemented at a particular institution, careful consideration must be given to the structural arrangement of the model. Further changes in the organizational structure of the institution can be simulated on the model at an increased cost, but a short manual procedure before this is attempted would be desirable. This procedure could keep cost down, as well as, being able to visualize the problems which could arise.

5. Other comments regarding the implementation, validation, and evaluation of CAMPUS/COLORADO are as follows:

a) A cross-over program (or using all OE codes) should be developed to insure the compatibility of these codes. Since OE codes are in mandatory use for occupational, vocational-technical programs by the Federal Government, some method must be found to introduce them into the system or get the Federal Government to change.

b) Increased modular programming must become more of a realty with the CAMPUS/COLORADO model. This would tend to reduce the length of runs, increase its flexibility, and reduce costs. Separate modules for each major entity could be one possibility. For example, finance, faculty, and students may be desirable break-downs.

c) A distinct cash or accrual accounting system must be developed on a state-wide basis with a common data base. While greater strides are being made in this area, the accomplishments are not necessarily being integrated into the CAMPUS/COLORADO model. Many new ideas are being tried at the state level, but unfortunately, many are being done in isolation of the model. There must be considerably more cooperation and coordination at the state level. This is not to say that efforts are not being made at that state-level; but, the single most important aspect of state-wide operations is successful coordination of the respective groups.

Without this detailed coordination, no state-wide system can survive.

d) Very careful consideration must be given to seeking short and long range information from the Joint Budget Committee (JBC) and the Executive Budget Office (EBO). Their input is extremely valuable. Likewise, these two groups must be kept fully aware of the desires of the separate state agencies and departments such that there is continuous grounds for mutual and satisfactory exchange of ideas.

e) Careful consideration must be given to a faculty activity analysis (FAA) that operates on a state-wide basis. Faculty work loads must be studied so that differences must be fully recognized, accounted for, and appropriate monetary recognition be made. An early result to this problem would prove most valuable, not only to insure a more equitable approach, but there would then be a sound basis for meeting any future need resulting from negotiations.

6. A Central State-Wide Computer Center

A separate contralized ADP center for all of higher education or post-secondary education should be planned, staffed, and fully implemented. The planning stage must be very carefully studied to handle current institutional needs as well as anticipating as much as possible, future needs. Currently,

there is a dire shortage of personnel at the state level to handle the increased legislative demands as well as the requirements of increased sounder management and accountability, all three of which are integrated and overlapping demands.

Emphasis in a state-wide computer center should be placed on peripheral equipment which can graphically display two and three demensional data. A picture is worth a thousand words. This procedure also tends to reduce the morass of numeric data down to quickly readable form. Interpretive time is also reduced considerably.

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* Bibliographies in these two books are excellent sources for additional information.